PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-288105
(43)Date of publication of application : 04.10.2002

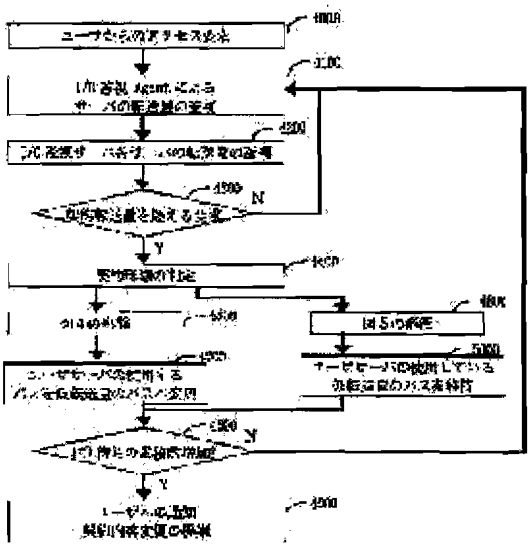
(51)Int.Cl. G06F 13/10
G06F 3/06

(21)Application number : 2001-087233
(22)Date of filing : 26.03.2001

(71)Applicant : HITACHI LTD
(72)Inventor : MIYAZAWA YOSHIHIKO
MURAKAMI MASAHARU
WATANABE TAKESHI

(54) STORAGE AREA NETWORK SYSTEM, METHOD FOR ITS OPERATION, STORAGE, AND DATA TRANSFERRING QUANTITY MONITORING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To guarantee the access performance of a user terminal to an SAN(storage area network) system.
SOLUTION: In the storage area network system, each user server has a prescribed data transferring quantity regulated to each in data transmission and reception through an I/F port with a magnetic disk device, the data transferring quantity between each user server and the magnetic disk device is obtained and monitored (4200), the regulated data transferring quantity of the user server is compared with an obtained actual data transferring quantity (4300) and the I/F port of a storage is selected according to this comparing result to give an instruction of connection to this port to a corresponding server (4700). Thus, in the SAN system to be applied to SSP(storage server provider), IDC(Internet data center), etc., a line capacity which a user serve can transfer in a fixed period is restricted, thereby it is possible to secure keeping of response performance as the whole system.



(JP2002-288105 A)

* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1]In an operation method of a storage area network system which two or more servers access storage via a Storage Area Network, and sends and receives data, Data transfer quantity between said each server and said storage is acquired and supervised, Measure data transfer quantity as which said server was specified, and acquired actual data transfer quantity, and either of two or more ports established in said storage according to this comparison result is chosen, An operation method of a storage area network system giving directions linked to the port concerned to a server of relevance.

[Claim 2]If data transfer quantity between said server and said storage exceeds data transfer quantity of said regulation, An operation method of the storage area network system according to claim 1 giving directions switched to said port of a lower data transfer rate as a connection destination in said storage of the server concerned to the server

concerned.

[Claim 3]It is determined that access frequency to said storage is lower than predetermined frequency, If data transfer quantity between said server to which said data transfer quantity for every access is moreover determined below as a predetermined transferring amount, and said storage exceeds said regulation data transfer quantity, An operation method of the storage area network system according to claim 2 giving directions which switch a connection destination in said storage of the server concerned to said port of a lower data transfer rate to the server concerned.

[Claim 4]As opposed to said server to which it is provided that access frequency to said storage is higher than predetermined frequency, and said data transfer quantity for every access is moreover determined below as a predetermined transferring amount, An operation method of the storage area network system according to claim 1 giving directions linked to said port whose data transfer rate is not the maximum to a server of relevance.

[Claim 5]A storage area network system which two or more servers access storage via a Storage Area Network, and sends and receives data, comprising:

Several ports where said storage differs in a data transfer rate, respectively.

Data storage resources connected to these ports.

[Claim 6]If said server exceeds said regulation data transfer quantity, said data-transfer-quantity monitor means, The storage area network system according to claim 5 giving directions switched to said port of a lower data transfer rate as a connection destination in said storage of the server concerned to the server concerned.

[Claim 7]It is determined that said data-transfer-quantity monitor means has access frequency lower than predetermined frequency to said storage, The storage area network system according to claim 6, wherein said data transfer quantity for every access moreover performs said port change directions to said server determined below as a predetermined transferring amount.

[Claim 8]It is determined that said data-transfer-quantity monitor means has access frequency higher than predetermined frequency to said storage, The storage area network system according to claim 5 giving directions linked to said port in which said data transfer rate is not the maximum to a server of relevance to said server to which data transfer quantity for every access is moreover determined below as a predetermined transferring amount.

[Claim 9]It has several ports which differ in a data transfer rate, respectively, and the data storage resources connected to these ports, Are accessed by two or more servers via a Storage Area Network, through said each port, are the storage which sends and receives data and Data transfer quantity of regulation of said server, Storage characterized by sending and receiving said data via said port selected as a connection destination of the server concerned according to a comparison result with actual data transfer quantity between said each server and said storage.

[Claim 10]Storage used with an operation method of the storage area network system according to any one of claims 1 to 5.

[Claim 11]Several ports which differ in a data transfer rate, respectively, comprising, A data-transfer-quantity monitoring instrument which supervises data transfer quantity between said each server and said storage when two or more servers send and receive data via a Storage Area Network to storage which has the data storage resources connected to these ports.

A means to acquire said data transfer quantity between said each server and said storage.

A means to measure data transfer quantity of regulation of said server, and acquired actual data transfer quantity.

A means to choose said port of said storage according to this comparison result.

A means to output directions which make the selected port concerned a connection destination of a server of relevance.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to a storage area network system, its operation method, storage, and a data-transfer-quantity monitoring instrument.

[0002]

[Description of the Prior Art]For mitigation of the complexity of recent years and a system management, or system management management cost, An Internet data center ("IDC" is called hereafter.), a storage service provider ("SSP" is called hereafter.), etc. kept the server in response to commission of a company etc., and the service which carries out central control of the employment and data has accomplished a rapid growth.

[0003]The Storage Area Network which used the fiber channel which enables movement of a high speed and long-distance data especially if it was in this IDC and SSP. ("SAN" is called hereafter.) -- the storage management is concentration-ized by building the SAN system which received and connected two or more servers and storage. This storage

comprises a large-scale disk array which equipped many mass magnetic disks, and carries out central control of a lot of entrusted various data. An end user accesses the user server in IDC or SSP from the information terminal (a "user terminal" is called hereafter.) of self through a Wide Area Network ("WAN" is called hereafter.), a Local Area Network ("LAN" is called hereafter.), etc. According to the demand from a user terminal, it connects with storage through SAN, and a user server sends and receives data.

[0004]In such a SAN system, it is necessary to control the data transfer quantity sent and received in order to accept the data transfer request concentrated from each server. When a user terminal accessed storage via a user server conventionally, the method which controls the data transfer quantity which can be sent and received was taken, and the connecting speed (line speed) applied to data transfer using the switching hub on the network connected to the server, etc. was restricted. For that purpose, the expensive switching hub had to be introduced into the entrance of the network linked to WAN, and introduction cost became big-ticket.

[0005]

[Problem(s) to be Solved by the Invention]Then, these people proposed the method which restricts the speed of data transfer between a server and storage, without using an expensive switching hub. That is, the port of two or more Fibre Channels with which the storage side is equipped is made for data transfer rates to differ mutually, respectively. Various data transfer which each server requires as these port groups being is supported. As concrete employment, the data transfer quantity of the regulation to every server that a contract with the user of service is also is defined, and each server chooses the port of storage suitable for self data transfer quantity, and is performing data transfer.

[0006]However, a server may carry out the demand beyond the data

transfer quantity of the regulation defined by the contract. If the demand of the data transfer beyond such unexpected prediction is accepted, trouble will arise in other data transfer and the response performance to the demand from each server will fall as the SAN whole system.

[0007]If it is as a contract when an example is given, and the data transfer request from a certain server occurs, When the demand of the data transfer quantity beyond regulation occurs at a certain time the place which should be able to be managed with usual if the port of the line speed of 60 or less MB/S is used, Since the conventional storage does not have a port which can control a transfer rate, it will use the transfer rate of the maximum velocity currently prepared by the storage side. Then, when another server requires mass data transfer, it becomes impossible to carry out selection use of the port of the maximum velocity which was originally usable, the trouble that data transfer is delayed will arise, and response performance will fall as the SAN whole system.

[0008]that such a technical problem should be solved, it is made and this invention comes out. the purpose prevents response performance from falling as the whole system, and is in boiling markedly the efficiency of the whole data transfer between the storage through SAN, and two or more servers, and raising it.

[0009]

[Means for Solving the Problem]If it is in an operation method of a storage area network system concerning this invention that said purpose should be attained, In an operation method of a storage area network system which two or more servers access storage via a Storage Area Network, and sends and receives data, Data transfer quantity between said each server and said storage is acquired and supervised, Data transfer quantity as which said server was specified, and acquired actual

data transfer quantity are measured, and either of two or more ports established in said storage according to this comparison result is chosen, and suppose that directions linked to the port concerned are given to a server of relevance.

[0010]If it is in a storage area network system concerning this invention that said purpose should be attained, Access storage via a Storage Area Network, and two or more servers are the storage area network systems which send and receive data, and said storage, While having several ports which differ in a data transfer rate, respectively, and the data storage resources connected to these ports, About said each server, predetermined data transfer quantity is specified about said data transmission and reception which led said port with said data storage resources of said storage, Have a data-transfer-quantity monitor means which acquires and supervises data transfer quantity between said each server and said storage, and this data-transfer-quantity monitor means, Said regulation data transfer quantity of said server and acquired actual data transfer quantity are measured, and said port of said storage is chosen according to this comparison result, and suppose that directions linked to the port concerned are given to a server of relevance.

[0011]If it is in storage concerning this invention that said purpose should be attained, It has several ports which differ in a data transfer rate, respectively, and the data storage resources connected to these ports, Are accessed by two or more servers via a Storage Area Network, through said each port, are the storage which sends and receives data and Data transfer quantity of regulation of said server, Suppose that said data is sent and received via said port selected as a connection destination of the server concerned according to a comparison result with actual data transfer quantity between said each server and said storage.

[0012]If it is in a data-transfer-quantity monitoring instrument

concerning this invention that said purpose should be attained, As opposed to storage which has several ports which differ in a data transfer rate, respectively, and the data storage resources connected to these ports, When two or more servers send and receive data via a Storage Area Network, A means to be a data-transfer-quantity monitoring instrument which supervises data transfer quantity between said each server and said storage, and to acquire said data transfer quantity between said each server and said storage, Suppose that it has a means to output a means to measure data transfer quantity of regulation of said server, and acquired actual data transfer quantity, a means to choose said port of said storage according to this comparison result, and directions that make the selected port concerned a connection destination of a server of relevance.

[0013]

[Embodiment of the Invention]= The example of composition of a ====SAN system = the example of composition which applied the SAN system concerning ==== this invention to SSP or IDC is shown in drawing 1. As shown in drawing 1, in the SAN system, two or more user servers 1400, 1500, and 1600 and the magnetic disk drive (storage) 2300 are connected via SAN1700.

[0014]The magnetic disk drive 2300 has the large-scale disk array which equipped many mass magnetic disks (hard disk), and the I/F ports 2000, 2100, and 2200 of a data transfer rate (line speed) different, respectively are equipped. The I/F port 2000 provides the maximum data transfer rates (No Limit), such as 100 MB/S. The data transfer rates of the I/F port 2100 are 60 MB/S of medium speed, and the data transfer rates of the I/F port 2200 are 30 MB/S of a low speed. The I/each F ports 2000, 2100, and 2200 are fundamentally connected with all the magnetic disks. Therefore, the magnetic disk drive 2300 is provided with the function which can carry out multidata input of the path with which each user

servers 1400, 1500, and 1600 access either of the I/each F ports 2000, 2100, and 2200 at a specific disk since it is available. It becomes possible for the user servers 1400, 1500, and 1600 to choose the port of a suitable transfer rate to the self specific disk which should be accessed, and to perform data transfer by this. Data transfer between each user servers 1400, 1500, and 1600 and the magnetic disk drive 2300 is performed through a these I/each F port.

[0015]Each user servers 1400, 1500, and 1600 are equipped with the I/O surveillance agent.While recording the log of the data transfer performed between the user servers 1400, 1500, and 1600 and the magnetic disk drive 2300, this agent, The transmission rate of input and output ("I/O" is only called hereafter.) of data, etc. are totaled for every physical disk in the magnetic disk drive 2300 which actually performed record/read-out. The I/O surveillance server 1900 (data-transfer-quantity monitor means) is connected to each user servers 1400, 1500, and 1600 via LAN. This I/O surveillance server 1900 supervises about the I/O access request and data transfer quantity of each user servers 1400, 1500, and 1600. This I/O surveillance server 1900 acquires the total record about each data transfer from the I/O surveillance agent of each user server, and, specifically, supervises it. Based on this monitored result, the I/O surveillance server 1900, The port of the magnetic disk drive 2300 which is a connection destination of each user servers 1400, 1500, and 1600 is suitably chosen so that the response performance to the data transfer request from each user servers 1400, 1500, and 1600 may not fall as the SAN whole system. In response, the path to the specific disk which each user servers 1400, 1500, and 1600 should access is changed, and it enables it to send and receive data through the I/F port of a suitable transfer rate.

[0016]To each user servers 1400, 1500, and 1600. Remote

console(remote console)1800 is connected via LAN and initial setting, a setting variation, etc. of each part device which constitute a SAN system as this Remote console1800 is are made possible.

[0017]The user terminals (client) 1000, 1100, and 1200 receive the various services which accessed via WAN and LAN and used the data of the magnetic disk drive through the user servers 1400, 1500, and 1600 which should be used to this SAN system.

[0018]= An operation method of a ====SAN system = describe one example of the operation method of the SAN system concerning ==== this invention. First, if an outline is explained, the user who deposits a user server and entrusts data management will conclude the fee collection contract beforehand about data transfer between the magnetic disk drives 2300, respectively. The contents of this fee collection contract determine beforehand the data volume which can be transmitted between fixed time according to the usage pattern, may not be concerned with the transmitted data volume when charging according to the data volume transmitted between this fixed time, but may make it a fixed amount. And when there is an access request beyond the data transfer quantity beyond conditions of contract. According to each conditions of contract, the decline in the data transmission efficiency of the SAN whole system, i.e., access performance, is prevented by making a data transfer rate fix to a fall or an always lower data transfer rate automatically.

[0019]<< <data-transfer-quantity monitor method >>> As shown in drawing 2, first the I/O surveillance server 1900, It directs to start the commands (for example, iostat, sar, etc.) for carrying out self monitoring of the data transfer quantity with the magnetic disk drive 2300 to the user servers 1400, 1500, and 1600. Next, the I/O surveillance server 1900 collects the data transfer quantity within the predetermined time as a self monitoring result from each user servers 1400, 1500, and 1600. This

collected data transfer quantity is matched for every disk of the magnetic disk drive 2300, as shown in the example of the table 1 of drawing 3. And the I/O surveillance server 1900 uses the device file name of each disk as a key, and totals the data transfer quantity of each user servers 1400, 1500, and 1600. And as shown in the table of drawing 4, comparison with the actual data transfer quantity per unit time obtained as a result of the total and the data transfer quantity of the regulation a contract of was made is performed for every [each user servers 1400 and 1500 and] 1600.

[0020]When actual data transfer quantity exceeds regular data transfer quantity as a result of this comparison, the port of the magnetic disk drive 2300 used at the time of data transfer is changed by changing a path depending on the contract form of a user server. As the change rule of the path for this port change is beforehand defined in I/O surveillance Saba 1900, for example, it is shown in the table of drawing 5, the path according to three steps of priorities is defined. For example, about the user server 1, as shown in the block diagram of drawing 6, The port (No Limit) of the highest data transfer rate that does not have restriction as the high path c0 of a priority is assigned, and then the port of the data transfer rate (60 MB/S) of medium speed is assigned as the high path c2 of a priority. And the port of the data transfer rate (30 MB/S) of medium speed is assigned as the path c1 of the third priority.

[0021]In << <example >>> this example, two kinds of cases are assumed as an example of data transfer. It is when the access frequency from a user server is comparatively low and the data transfer quantity at the time of access which is moreover 1 time is comparatively large as the first case. As the second case, the access frequency from a user server is higher than predetermined frequency, and is when the data transfer quantity at the time of 1-time access is moreover comparatively smaller

than a predetermined transferring amount.

[0022]First, about the first case, drawing 7 is made reference and explained. In the conditions of contract of this first case, a maximum performance realizable by a system is made usable to a user. That is, the I/F port 2000 of the maximum data transfer rate is made available. The data volume which can be transmitted between fixed time is decided beforehand, and it charges according to the data volume which can be transmitted between this fixed time. The I/O surveillance server 1900 in the basis of these conditions of contract and drawing 1 supervises the data transfer quantity from each user servers 1400, 1500, and 1600, and compares whether it is over the data transfer quantity of the regulation defined by the contract. As shown in number"3000" in drawing 7 as a result of this comparison, when the data transfer beyond regular data transfer quantity occurs, As number"3100" in drawing 7 shows, in a next access (data transfer) demand the I/O surveillance server 1900, The I/F port which the user servers 1400, 1500, and 1600 of relevance use is changed to a low-speed (60 MB/S) thing (2100 of drawing 1), and the maximum of a data transfer rate is restricted. The part beyond regular data transfer quantity is incorporated and appropriated for the data transfer quantity at the time of next access. When data transfer time is short and data transfer quantity falls within a contract range after changing to the low-speed I/F port and restricting the maximum of a data transfer rate, As shown in number"3200" in drawing 7, the restriction measure of a data transfer rate is canceled and it becomes possible to use the port of a maximum transfer rate as before.

[0023]The change of this I/F port is performed by issuing the directions which change an I/F port from the I/O surveillance server 1900 to each user servers 1400, 1500, and 1600, as the flow of a path change is shown in drawing 8. The directions which change this I/F port use the shift path

function with which each user servers 1400, 1500, and 1600 were equipped. It becomes possible to almost change an I/F port in an instant, without stopping data transmission and reception of a user server, if the shift path function of these user servers 1400, 1500, and 1600 is used.

[0024]As mentioned above, as explained, when the data transfer quantity of the regulation defined by the contract is exceeded, at the time of the data transfer by the next access, the data transfer quantity between the user server of relevance and the magnetic disk drive 2300 is controlled. That is, the data transfer rate between the magnetic disk drive 2300 in drawing 1, the user servers 1400 and 1500, and 1600 will fall. By this, the I/F port 2000 of the maximum data transfer rate can be released, the data transfer request from other user servers can be met, the situation where the response of the SAN whole system falls can be avoided, and good response performance can be maintained. Although the data transfer rate which the user servers 1400, 1500, and 1600 required will be restricted on the other hand, although the data transfer quantity at the time of one access is comparatively large, in this first case, the access frequency from the user servers 1400, 1500, and 1600 is comparatively low. For this reason, even if a data transfer rate is restricted, data transfer quantity can be extended to a time base direction, and actual data transfer quantity can be dedicated within the limits of the data transfer quantity of the regulation defined by the contract.

[0025]Next, about the second case, drawing 9 is made reference and explained. A data transfer rate gives the I/O surveillance server 1900 to the server of relevance by directions linked to the I/F port which is not the maximum. That is, not the I/F port 2000 of the maximum data transfer rate but the I/F port 2100 of 60 MB/S and the I/F port 2200 of 30 MB/S are directed as a connection destination. The example is shown in drawing 9, always using the I/F port (the inside of drawing 1, 2100) of 60

MB/S.

[0026]Therefore, the data transfer quantity between the user server of relevance and the magnetic disk drive 2300 is controlled. That is, although the data transfer rate between the magnetic disk drive 2300 in drawing 1 and a user server will be restricted and access of the user terminal to a user server will always be restricted as a result, actual data transfer quantity can be dedicated within the limits of the data transfer quantity of the regulation defined by the contract. By this, the I/F port of the maximum data transfer rate can be released, the data transfer request from other user servers can be met, the situation where the response of the SAN whole system falls can be avoided, and good response performance can be maintained. Although the data transfer rate which the user servers 1400, 1500, and 1600 required will be restricted on the other hand, although the access frequency from the user servers 1400, 1500, and 1600 is comparatively high, in this second case, the data transfer quantity at the time of one access is comparatively small. For this reason, even if a data transfer rate is restricted, data transfer quantity can be extended to a time base direction, and actual data transfer quantity can be dedicated within the limits of the data transfer quantity of the regulation defined by the contract.

[0027]In the above, the job flow of the I/O access supervisor control containing the first and the second case which were explained is explained with reference to the flow chart shown in drawing 10. First, if there is an access request from a user terminal (4100), an I/O surveillance agent will supervise the data transfer quantity between the self user server which resides permanently, and the magnetic disk drive 2300 (4200). Next, the I/O surveillance server 1900 supervises by collecting data from a working I/O surveillance agent on each user server (the inside of drawing 1, 1400, 1500, 1600) (4200). As each user servers 1400

and 1500 and the I/O surveillance agent on 1600 mentioned above, the data transfer rate of I/O is totaled for every physical disk, and, specifically, these total data is collected by the I/O surveillance server 1900 via LAN. In the I/O surveillance server 1900, the data transfer rate of each collected user servers 1400, 1500, and 1600 is totaled for every port of the fiber channel of the magnetic disk drive 2300. It is judged whether an I/O surveillance server measures the actual data transfer quantity of each user servers 1400, 1500, and 1600, and the data transfer quantity of the regulation a contract of was made based on this totaled result, and is over the data transfer quantity of this regulation (4300). When the I/O transferring amount of each server is over regular data transfer quantity, processing is distributed according to conditions of contract (4400).

[0028]For example, in the case of the first case as conditions of contract show to drawing 4, the path which a user server uses is changed into the path of a low transfer rate (4700). The changing method of the I/F port of the magnetic disk drive which the user servers 1400, 1500, and 1600 use, The I/O surveillance server 1900 emits the switching instruction of a port to the user servers 1400, 1500, and 1600 of relevance by a LAN course as mentioned above, During I/O access, the terminal which an end user uses as each user servers 1400, 1500, and 1600 which received this are also by the shift path function of self almost changes a path in an instant. If it seems that an I/O surveillance agent's I/O waiting increases cumulatively in spite of it in the passage of (7) of drawing 3 (4800:YES), the fall of the response which starts data transfer to the user terminal of relevance in a user server course will be notified, and change of the fee collection system a contract of is made will be proposed (4900). If there is no cumulative increase in the waiting for I/O (4800:NO), it will return to the processing of 4100 mentioned above.

[0029]On the other hand, as it mentioned above in the processing (4400) which distributes processing according to conditions of contract in the case of the second case (4600) as conditions of contract show to drawing 5 an I/O surveillance server, A data transfer rate gives directions linked to the I/F port which is not the maximum to the server of relevance (5000). That is, not the I/F port 2000 of the maximum data transfer rate but the I/F port 2100 of 60 MB/S and the I/F port 2200 of 30 MB/S are directed as a connection destination. And if it seems that the waiting for I/O increases cumulatively in spite of it (4800:YES), change of the fee collection system a contract of is made will be proposed (4900). If there is no cumulative increase in the waiting for I/O (4800:NO), it will return to the processing of 4100 mentioned above.

[0030]As mentioned above, the explained example is one example of this invention to the last, and change and a design variation are possible for it in the range which does not deviate from the meaning of this invention. For example, the function of the I/O surveillance server 1900 in drawing 1 may be given to the magnetic disk drive 2300.

[0031]

[Effect of the Invention]Only the part which can omit an expensive switching hub etc. can reduce introduction cost. It can avoid occupying a high-speed port superfluously by lowering the unnecessary frequency in use of the port which has a high-speed transfer rate as much as possible. Therefore, it accesses by high frequency, and use of the high-speed port originally needed for the server which requires big data transfer is closed if possible. the efficiency of the whole data transfer between the storage which passed the stray JIERI owt work as **, and two or more servers can be boiled markedly, and can be raised. Therefore, it becomes possible to guarantee the access performance of the user terminal to the SAN system used as SSP or IDC.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a lineblock diagram showing one example of the SAN system concerning this invention.

[Drawing 2]It is a job flow figure at the time of the monitoring server in one example of this invention acquiring data transfer quantity from a user server.

[Drawing 3]The monitoring server in one example of this invention is a chart showing signs that the data transfer quantity of each user server is totaled.

[Drawing 4]It is the compared chart of the data transfer quantity per actual unit time and regulation data transfer quantity in one example of this invention.

[Drawing 5]It is a chart showing the priority of a change of the path of each user server in one example of this invention.

[Drawing 6]It is a chart showing the priority of the path change to the specific disk which the user server 1 in one example of this invention accesses.

[Drawing 7]It is a graph which shows the example of a usage pattern when the amount of data transfers sent and received to the fixed time in one example of this invention is large.

[Drawing 8]The user server which received the switching instruction of the path from the monitoring server in one example of this invention is a job flow figure showing signs that a path is changed.

[Drawing 9]It is a graph which shows the example of a usage pattern when the transferring amount of the data sent and received to the fixed

time in one example of this invention is constant.

[Drawing 10]It is a flow chart which shows an example of the operation method of the SAN system in one example of this invention.

[Description of Notations]

1000 User terminal 1

1100 User terminal 2

1200 User terminal 3

1300 WAN (world area network)

1400 User server 1

1500 User server 2

1600 User server 3

1700 SAN (Storage Area Network)

1800 Remote console

1900 I/O surveillance server

2000-2100, the I/F port of 2200 magnetic disk drives

2300 Magnetic disk drive